2.7 Hardy-Weinberg Principle

- Two mathematicians, Hardy and Weinberg, used mathematical reasoning to explain the relationship between gene frequencies within a population and the chances of those frequencies remaining constant.
- Formula: $p^2 + 2pq + q^2 = 1$

  $p + q = 1$

New Terms:

- Allele – a specific form of a gene
- Gene pool – total of all alleles within a population.
- Allele frequency – the proportion of gene copies in a population of a given allele.

- The Hardy-Weinberg Principle provides a baseline to determine whether or not gene (allele) frequencies have changed over time or if evolution has occurred.

A – dominant allele – ***p***

a – recessive allele – ***q***

(H-W letter)

p + q = 1 (allele formula)

- With 2 alleles, both of their frequencies when put together equal 100% or 1 in the formula.
- i.e. if 70% of population have ***A*** alleles then ____% has ***a*** allele

$$p^2 + 2pq + q^2 = 1$$

Genotype formula

PP
Homozygous dominant

pq
Heterozygous

qq
Homozygous recessive

Example #1

- A population has only two alleles, R and r, for a particular gene. The allele frequency of R is 20%. What are the frequencies of RR, Rr, and rr in the population?

Example #2

- Determine the frequency of both alleles in a population where q^2 is 25%

The Hardy-Weinberg equilibrium is maintained only if all five of the following conditions are met:

- The population is very large
- No migration of individuals into or out of the population
- No mutations occurs
- Mating opportunities are equal
- No natural selection occurs

****Hardy-Weinberg equilibrium describes the genetics of ideal populations that never exist in nature****

Why is it important?

- It tells us what to expect for a non-evolving population, providing a **baseline** for comparing actual populations where the gene pools may in fact be changing.